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ABSTRACTS

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Metastability and Relaxation in Quantum and Mesoscopic Systems

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The transient dynamics and the relaxation of three quantum and mesoscopic systems are investigated. In particular we analyze: (i) a long Josephson junction (LJJ) driven by a non-Gaussian Lévy noise current; (ii) a metastable quantum dissipative system driven by an external periodical driving; and (iii) the electron spin relaxation process in n-type GaAs crystals driven by a fluctuating electric field. Specifically, in the first system the LJJ phase evolution is described by the perturbed Sine-Gordon equation. We find the noise enhanced stability and resonant activation phenomena, by investigating the mean escape time as a function of the bias current frequency, noise intensity and length of the junction. Moreover, the role of the soliton dynamics, induced by the noise on the switching events of the LJJ, is highlighted. In the second system, the asymptotic population of the metastable state as a function of the bath temperature, coupling strength and parameters (frequency and amplitude) of the external driving is analyzed in the framework of Caldeira-Leggett model and discrete variable representation. The asymptotic population of the metastable state, as a function of the driving frequency, displays a strong non monotonic behavior with a maximum, showing a quantum noise induced stability effect. Finally, the electron spin relaxation process is analyzed in the presence of two different sources of fluctuations: (a) a symmetric dichotomous noise and (b) a Gaussian correlated noise. Monte Carlo numerical simulations show, in both cases, an enhancement of the spin relaxation time by increasing the amplitude of the external noise. Moreover, we find that the electron spin lifetime versus the noise correlation time shows: (a) a monotonic increasing behavior in the case of dichotomous random fluctuations, and (b) a nonmonotonic behavior with a maximum in the case of bulks subjected to a Gaussian correlated noise.

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